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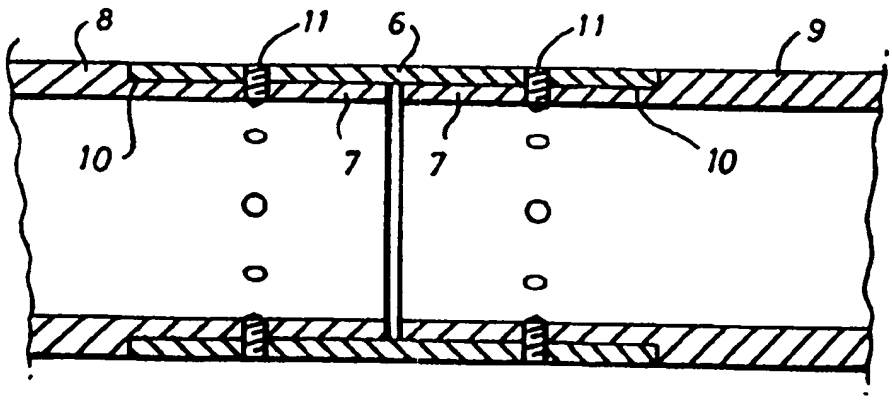

(57) Abstract

A connector for interconnecting a pair of adjacent sections (8 and 9) of an expandable tubing string comprises a plastically expandable sleeve (6) that is arranged co-axially around or inside the ends (7) of the interconnected tubing sections (8 and 9) and a series of circumferentially spaced mechanical fasteners (5), such as screws or rivets, for fastening the sleeve to each of said ends (7).

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CONNECTOR FOR AN EXPANDABLE TUBING STRING

The invention relates to a connector for use in connecting sections of an expandable tubing string, and in particular but not exclusively for use in the connection of sections of an expandable slotted tubing (EST) string as utilized in downhole applications in oil and gas production operations.

Expandable slotted tubings are known from International patent application No. PCT/EP 93/01460. This prior art reference discloses a slotted tube which may be expanded downhole by running an expansion mandrel through the tubing whereby the slots are expanded to diamond-shaped apertures.

When a tubing is expanded it is desirable that this can be accomplished by a substantially uniform expansion force, also at the locations where adjacent tubing sections are interconnected.

It is therefore an object of the present invention to provide a connector for an expandable tubing that can be expanded smoothly and made up easily without requiring welding operations.

The connector according to the invention thereto comprises a plastically expandable sleeve that is in use arranged co-axially relative to an end of each of the adjacent tubing sections, and means for fastening the sleeve to said ends.

Preferably the outer surface of an end of each of the adjacent tubing sections has been machined away to form an annular recess in which the sleeve is located.

Alternatively the inner surface of an end of each of the adjacent tubing sections has been machined away to form an annular recess in which the sleeve is located.

It is preferred that the thickness of the sleeve is substantially equal to the depth of the annular recess so that a flush-type connection is created.

It is furthermore preferred that the fastening means comprise a series of circumferentially spaced screws that pass through holes that are drilled through the sleeve and the adjacent wall of ends of the adjacent tubing sections. If desired the screws may be replaced by rivets or other mechanical fasteners.

The connector according to the invention is particularly attractive for interconnecting sections of an expandanble string of oil and/or gas well tubulars that may be slotted. If the connector is used for interconnecting sections of an expandable slotted tubing string then the sleeve is provided with a series of staggered substantially longitudinal slots which are deformable into diamond-shaped apertures upon expansion of the sleeve.

Further aspects, details, objects and advantages of the connector according to the invention will become apparent from the accompanying claims, abstract, drawings and detailed description with reference to the drawings.

The invention will now be described in more detail with reference to the accompanying drawings, in which

Fig. 1 shows a schematic side view of a plastically expandable connector according to the invention which surrounds ends of adjacent expandable slotted tubing sections;

Fig. 2 shows a schematic longitudinal sectional view of a flush-type connector according to the invention which surrounds ends of adjacent expandable tubing sections; and

Fig. 3 shows a schematic longitudinal sectional view of a flush-type connector according to the invention which is surrounded by ends of adjacent expandable tubing sections.

Referring now to Fig. 1, there is shown a connector comprising a plastically deformable slotted sleeve 1 that co-axially surrounds ends of a pair of adjacent slotted tubing sections 2 and 3. The sleeve 1 and tubing sections are each provided with a series of staggered and partially overlapping slots 4 that deform to substantially diamond shaped apertures (not shown) upon expansion of the assembly by e.g. running an expansion mandrel (not shown) through the interior of the tubing sections 2 and 3.

One or more series of circumferentially spaced Allen-type or other locking screws 5 fasten the sleeve 1 to each of the tubing sections 2 and 3 such that the inner surface of the sleeve 1 engages the outer surface of the end of each tubing section 2 and 3 both before, during and after the expansion process. The screws 5 are located in nodes between slots 4.

Referring now to Fig. 2 there is shown a flush-type connector comprising a plastically deformable solid or slotted sleeve 6 that surrounds ends 7 of adjacent solid or slotted tubing sections 8 and 9, which ends 7 have been machined away to form an annular recess 10 in which the sleeve 6 is located. The thickness of the sleeve 6 substantially equals the depth of the recess 10 to form a flush-type connector.

The connector furthermore comprises a series of circumferentially spaced Allen-type or other locking screws 11 to fasten the sleeve 6 to each of the tubing sections 8 and 9 such that the inner surface of the sleeve 6 engages the outer surface of the ends 7 of the adjacent tubing sections 8 and 9 both before, during and after the expansion process.

Referring now to Figure 3 there is shown a flush-type connector comprising a plastically deformable solid or slotted sleeve 16 that is surrounded by ends 17 of adjacent solid or slotted tubing sections 18 and 19, respectively, which ends 17 have been machined away to form an annular recess 20 in which the sleeve 16 is located. The thickness of the sleeve substantially equals the depth of the recess 20 to form a flush-type connector that smoothly deforms plastically together with the ends of the tubing sections 18 and 19 during the expansion process.

The connector of Fig. 3 furthermore comprises a series of circumferentially spaced Allen-type locking screws 21 to fasten the sleeve 16 to each of the tubing sections 18 and 19 such that the outer surface of the sleeve 16 firmly engages the inner surface of the ends 17 of the adjacent tubing sections 8 and 9 both before, during and after the expansion process.

C L A I M S

1. A connector for interconnecting adjacent sections of a tubing string, the connector comprising a sleeve that is in use arranged co-axially relative to an end of each of the adjacent tubing sections, and means for fastening the sleeve to said ends, characterized in that the sleeve is plastically expandable and is useable for interconnecting sections of an expandable tubing string.

2. The connector of claim 1, wherein the sleeve is designed for interconnecting sections of an expandable slotted tubing string and is provided with a series of staggered substantially longitudinal slots which are deformable into diamond-shaped apertures upon expansion of the sleeve.

3. The connector of claim 1, wherein the sleeve is designed for interconnecting sections of an expandable string of oil and/or gas well tubulars.

4. The connector of claim 1, wherein the outer surface of an end of each of the adjacent tubing sections has been machined away to form an annular recess in which the sleeve is located.

5. The connector of claim 1, wherein the inner surface of an end of each of the adjacent tubing sections has been machined away to form an annular recess in which the sleeve is located.

6. The connector of claim 4 or 5, wherein the thickness of the sleeve is substantially equal to the depth of the annular recess.

7. The connector of any preceding claim, wherein the fastening means comprise a series of circumferentially spaced screws that pass through holes that are drilled through the sleeve and the adjacent wall of ends of the adjacent tubing sections.

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FIG.1

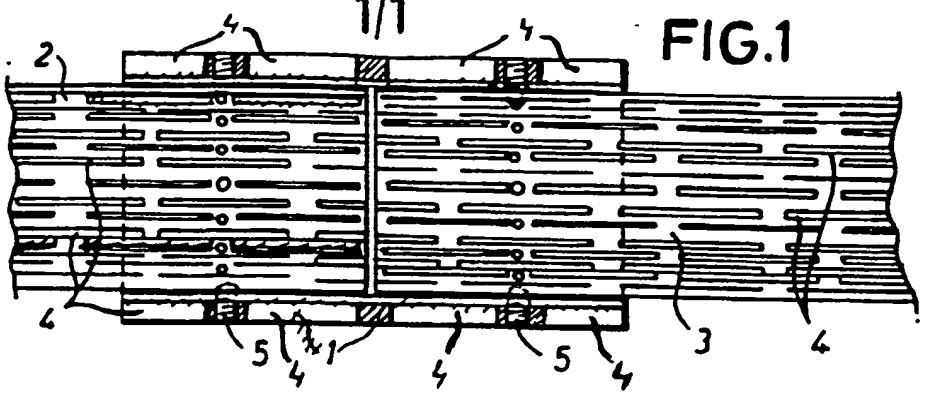


FIG.2

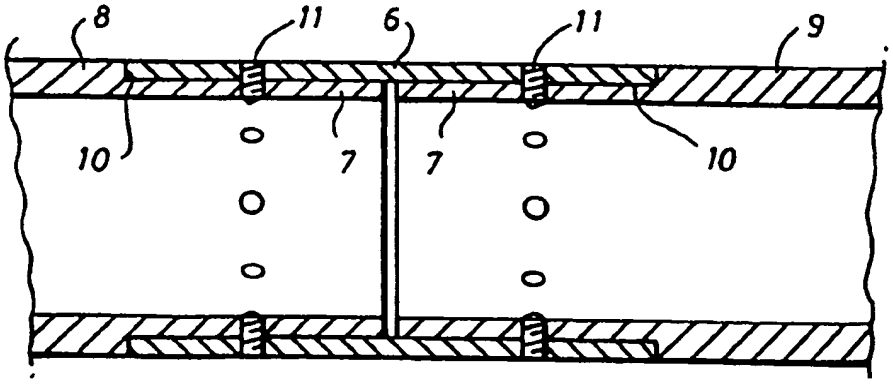
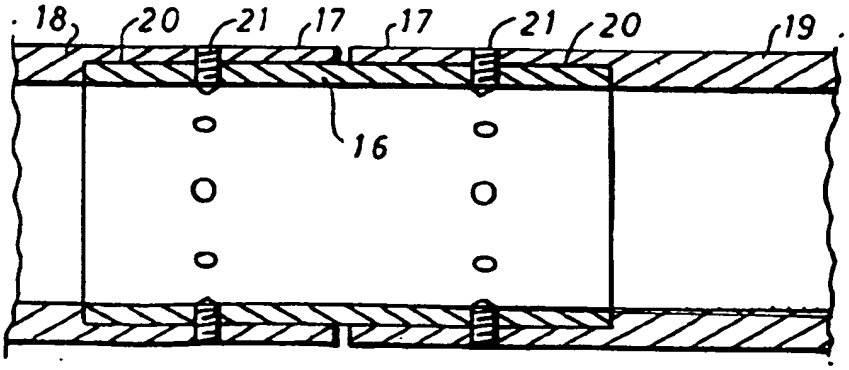


FIG.3



INTERNATIONAL SEARCH REPORT

Inte ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E21B17/08 E21B43/10 E21B43/08 F16L13/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E21B F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 948 321 A (OWEN) 6 April 1976 see column 5, line 13 - line 50 see column 7, line 37 - line 41	1,3-6
Y	---	2
Y	US 5 366 012 A (LOHBECK) 22 November 1994 cited in the application see the whole document	2

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[X] Further documents are listed in the continuation of box C.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
24 March 1998	30/03/1998

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